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Bank Holding Company Stock Risk and the Composition of Bank Asset Portfolios

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In this paper, I conduct an empirical analysis of the behavior of bank holding company stock returns with the goal of identifying the effect of portfolio composition on the risks embodied in those returns. Using a modified arbitrage pricing theory model, I test for significant balance sheet effects on both the market and nonmarket components of bank stock systematic risk. I find that several categories of bank assets are significant in explaining bank stock risk profiles. Among other things, I discuss the importance of these findings in light of the risk-based capital standards and suggest that noncredit types of risk may need to be incorporated into bank capital standards if capital levels are to reflect risk accurately.

A common theme in recent discussions of U.S. banks and banking markets is the evaluation of risk. While it is widely accepted that banks are in the business of taking and managing risks, the question arises why some banks are riskier than others, even in the face of similar economic conditions. This theme has been echoed in the press, in academic studies, and in speeches given by government officials and bank regulators. The importance of understanding the determinants of bank risk has been heightened by the recent poor performance of U.S. banks as well as by the ongoing incidence of bank failures. Moreover, the issue becomes a public policy concern each time another banking organization fails, thus requiring the FDIC to step in and spend funds out of its already diminished reserves.

In recent months, much of the discussion relating to bank risk has involved the risk-based capital standards being phased in among the Group of 10 countries in Europe, North America, and Asia. These standards require banks holding riskier assets to maintain a larger capital cushion against losses, thereby reducing the likelihood that losses will deplete bank capital and lead to failure. Unlike traditional capital regulations that establish a fixed amount of capital (relative to assets) for all institutions, the risk-based standards set a variable capital cushion based on the perceived credit risk of the bank's underlying assets.

In setting the appropriate amount of capital an institution must hold, the risk-based capital standards assign bank assets to a small number of categories, each with its own apparent degree of riskiness and, thus, its own risk weight. The categories (and the weights) were determined based on assessments of the credit risk associated with different classes of bank assets. Some critics of the risk-based capital requirements argue that the categories are too crude to be meaningful, that is, they ignore important information relevant to determining the risk of bank assets in order to streamline the standards and make them easier to implement. Others criticize the standards for failing to address non-credit types of risk, such as interest rate risk and asset concentration risk.

In the current study, I attempt to identify some of the determinants of bank risk by evaluating the influence of bank portfolio composition on the behavior of bank holding company stock returns. In an earlier study (Neuberger 1991), I estimated the sensitivity of bank stocks to overall stock market conditions and to changes in interest rates. I showed that these sensitivities have varied considerably over time and that significant differences exist among banks in the sensitivities their stocks display to these two factors. Starting from a similar perspective in the current work, I relate the observed sensitivity of bank stock returns to the composition of bank asset portfolios. If bank risk is explained at least partially by the decisions banks make in allocating funds among different assets, then we should observe systematic variations in bank stock sensitivity based on the profile of their asset portfolios.

A related goal of the current work is to evaluate bank stock risk in light of the risk-based capital standards. More specifically, I attempt to determine if some of the classes of assets considered less risky under the risk-based standards actually do exert less of an impact on the risk of bank stocks. For example, are single-family mortgage loans a "safer" investment than loans to private businesses? The risk-based capital standards assert that they are by requiring banks to hold half as much capital in support of a residential mortgage than a commercial and industrial loan. The analysis below sheds some light on whether such distinctions are empirically important by estimating the effect these different classes of assets have on bank stock risk.

I. Bank Stock Risk and Bank Portfolios

In order to address the role of portfolio composition on bank stock risk, I need an appropriate model of bank stock returns. One basic model of asset returns is the Capital Asset Pricing Model (CAPM), developed by Sharpe (1964) and Lintner (1965). In this model, the return on a company's equity shares over and above the return on a riskless asset is explained solely as a function of the return on the "market portfolio," a perfectly diversified portfolio of all assets. In practical applications of the CAPM, a broad-based stock market measure, such as the return index on the S&P 500, is used as a proxy for the return on the market portfolio, and the risk-free rate of return often is ignored. This model segregates asset risk into two broad categories: risk that is related to the return on the market portfolio, called market or systematic risk, and risk that is unrelated to the market return, so-called nonsystematic or residual risk.

The "market model" can be summarized by the equation:

$$(1) \qquad R_{jt} = \alpha_j + \beta_j R_{Mt} + \epsilon_{jt},$$

where R_{jt} is the return on asset j in period t, R_{Mt} is the return on the market portfolio of stocks, β_j is an estimated coefficient that represents the sensitivity of the return on asset j to overall stock market returns, α_j is an estimated constant term, and ϵ_{jt} is a residual.

The estimated beta value from equation (1) measures the covariance of the individual asset's return with the return on the overall stock market. If the asset return moves in proportion to changes in the overall market's return, then the estimated value of β_j will be close to 1. Such assets are said to have average market-related risk. An asset with β_j greater than 1 carries above average market risk and typically must provide an above average expected return in order to induce investors to hold it. The equity shares of banks holding well-diversified portfolios of assets are likely to exhibit about average market risk.

Despite the theoretical appeal of the CAPM, it often has been found wanting in empirical applications. More specifically, factors in addition to the return on the market portfolio have been found to be significant in explaining the returns on individual assets. For example, Stone (1974) suggested an extension of the basic CAPM formulation. He reasoned that asset returns ought to depend not only on the return on the market portfolio of stocks, but also on the return on an alternative debt instrument. This "two-index model" identifies two sources of systematic risk for asset returns: The first is equivalent to the systematic risk of the CAPM and is the risk associated with the return on the market portfolio; the second is related to returns on debt securities and is sometimes referred to as interest rate risk. Residual risk in this model is any risk that is unrelated either to the market return or to interest rates.[1]

It is notable that the stock returns of most companies do not exhibit any significant sensitivity to the debt return variable of the two-index model. However, the asset and liability characteristics of financial intermediaries would seem to make them likely candidates for significant sensitivity to interest rate changes. Bank and thrift holding company stock returns thus have been a frequent object of study by financial economists. The evidence on the interest rate sensitivity of financial intermediaries, however, is mixed. Chance and Lane (1980) and Sweeney and Warga (1986) found that financial institutions tended not to have consistent or significant sensitivity to changes in interest rates. They showed, instead, that the stocks of utilities as a group exhibited more pronounced interest rate risk than

[1]Stone (1974) originally proposed the two-factor model by appealing to an intuitive argument that asset returns ought to depend on alternative investments in the stock and bond markets. However, the model has a sound theoretical basis since it can be derived from Merton's intertemporal CAPM (1973).

any other industry grouping. In contrast, a number of other studies have shown that the stock returns of financial intermediaries do exhibit significant, though not necessarily stable, interest rate risk. Among the studies finding significant interest rate sensitivity at banks and thrifts are those conducted by Martin and Keown (1977), Lloyd and Schick (1977), Lynge and Zumwalt (1980), Beebe (1983), Flannery and James (1984a, 1984b), Booth and Officer (1985), Kane and Unal (1988), and Neuberger (1991).

Some authors have attempted to explain the market and interest rate sensitivity of bank stock returns by looking at bank operations, portfolio composition, or other market conditions. Rosenberg and Perry (1981) conduct such a study using the CAPM framework, while Dietrich (1986) uses a two-index approach to explain the risk sensitivity of bank stocks as a function of bank balance sheet composition. Both of these studies find some evidence that individual bank characteristics affect the risk of bank stock returns. Moreover, as these characteristics change over time, the risks of bank stocks also change.

Several studies of bank stock returns have focused specifically on their interest rate sensitivity. Some of this research arose over concerns that maturity mismatches by financial intermediaries may have left them dangerously exposed to interest rate swings. This may have been particularly important for thrift institutions in the early 1980s. Flannery and James (1984a), for example, derive a measure of maturity mismatch between bank assets and liabilities. After estimating a two-index model on a cross section of intermediary stock returns, they relate the estimated interest rate coefficients from this regression to their duration gap measure. They find that the maturity mismatch is significantly related to the observed interest rate risk of the bank and thrift stocks they study.

Both the CAPM and the two-index model can be considered special cases of a more general asset pricing framework, known as the arbitrage pricing theory (APT, Ross 1976). In this framework, asset returns are explained by their relationship to a number of common factors. The return on the market portfolio of stocks may be one such factor; changes in interest rates could be another. However, this more general framework allows for many other influences to affect asset returns in a systematic way. In its most general terms, the APT suggests that asset returns can be represented by the following process:

$$(2) \quad R_j = a_j + b_{j1}I_1 + b_{j2}I_2 + \ldots + b_{jn}I_n + e_j,$$

where the Is are the common factors or indexes that systematically affect asset returns and the bs (also called factor loadings in APT parlance) represent the sensitivity of the asset to the different indexes.

Equation (2) describes the process that generates asset returns. By itself, it says nothing about how financial assets should be priced in equilibrium. Nevertheless, the APT is an equilibrium asset pricing model. Like the CAPM, this model argues that only systematic risk matters for the pricing of assets. It ignores nonsystematic risk because such risk can be diversified away. In the APT, the systematic risk of any asset is characterized by the vector of bs from equation (2). This vector can be thought of as a multidimensional version of the market beta from the CAPM. According to the APT, assets that exhibit the same systematic risks must be priced in equilibrium to offer the same rate of return. If not, then investors could buy and sell the different assets and risklessly profit from the transaction. Opportunities for such riskless arbitrage prevent assets from selling at anything but their equilibrium prices.

The vector of bs from equation (2) summarizes the systematic risk of an asset and, according to the APT, is the primary determinant of the asset's price. This implies that the expected return on any asset can be described as a function of its vector of factor loadings. The theory also implies that each of these factor loadings should be "priced" in equilibrium. This means that every b should be associated with a risk premium. These risk premia measure the increased return that an investor receives for bearing the systematic risk associated with the corresponding factors and can be estimated using the equation:

$$(3) \quad E(R_j) = \lambda_0 + \lambda_1 b_{j1} + \lambda_2 b_{j2} + \ldots + \lambda_n b_{jn},$$

where λ_i is the risk premium that measures the increase in expected return for a one-unit increase in the ith factor loading.[2]

The APT predicts that all assets are affected by the same set of systematic factors. Unfortunately, the model provides no guidance as to which factors are important in explaining asset returns. A number of studies have attempted to identify possible sets of factors that are common across broad portfolios of assets (see, for example, Chen, Roll, and Ross 1986). In contrast to the factors, the APT predicts that asset risk profiles (that is, the set of factor loadings) differ across assets and likely depend on characteristics that are specific to each asset. Little empirical work has been done to investigate the characteristics of individual assets that are important in explaining their risk profiles.

[2]In applications of the APT, equation (2) is sometimes estimated for a sample of assets (or portfolios of assets) over a particular time period. The estimated vector of bs is extracted from these estimates, and then is used to estimate equation (3) over a different time period. This two-step procedure yields estimates of the risk premia associated with the different factors.

It is reasonable to assume that these risk profiles (the *b*s from equation (3)) depend on some distinguishing characteristics of each asset. In the case of banks, recent developments in capital regulation suggest that regulators view the composition of bank asset portfolios as an important determinant of bank risk. The risk-based capital guidelines set different required levels of capital for each of a number of categories of bank assets. These asset categories were established based on perceptions of the relative credit risks of the different assets. Box 1 provides some detail on the risk weights of several broad groupings of bank assets. In this paper, I use a modified APT model to test whether the stock market confirms this regulatory view that portfolio allocations are significant in explaining the risk of bank holding company stock returns.

Box 1

Selected Asset Categories and Risk Weights under the Risk-Based Capital Standards

Asset Category	Risk Weight
Treasury and Government Agency securities (includes GNMA mortgage-backed securities)	0 percent
FNMA and FHLMC mortgage-backed securities	20 percent
Privately issued mortgage-backed securities and residential mortgage loans	50 percent
Commercial & industrial loans and loans to individuals	100 percent

The risk-based capital standards set minimum capital ratios at 8 percent of risk-weighted assets. More specifically, the standards call for Tier 1 capital (mostly equity) of at least 4 percent, and sufficient Tier 2 capital to bring the total to 8 percent. Risk-weighted assets are determined as the book value of assets in each of the different categories multiplied by the corresponding risk weight. In effect, this means that banks must hold the full 8 percent of capital against assets in the 100 percent risk weight category, 4 percent against the 50 percent risk-weighted items, and no capital against zero risk-weight assets like Treasury securities.

The risk-based capital standards also establish required levels of capital to support off-balance sheet activities, such as interest rate and foreign exchange swaps and options. The required amounts of capital for these activities generally depend on the type and maturity of the contract and the cost of replacing an existing contract with a new one. These capital requirements are intended to reflect the credit risk associated with these activities and do not currently incorporate any hedging effects they may have on the interest rate or foreign exchange risk of the bank.

In this model, I assume there is one common factor for all bank stocks, namely, the return on the market portfolio. I then hypothesize that the proportion of bank portfolios allocated to different assets represents a set of characteristics that are important determinants of their risk profile and thus are significant in explaining bank stock returns. Defining P_{ji} as the proportion of the ith asset (relative to total assets) in the portfolio of bank j, this model can be expressed as

$$(4) \qquad R_{jt} = \alpha_j + \beta_j R_{Mt} + \textstyle\sum_i \lambda_{ji} P_{jit} + \epsilon_{jt}.$$

While equation (4) captures the direct effects of portfolio composition on bank stock returns, these asset shares also may exert an indirect influence by altering the market risk of bank stock returns. The original market model views an individual asset's beta as constant over time. However, subsequent research confirms that the sensitivity of bank stocks to the market portfolio (as well as to other systematic factors) is not constant (Kane and Unal 1988, Kwan 1991, Neuberger 1991). One interpretation of the market beta is that it represents an average of the market risks associated with each of the assets in the bank's portfolio. Changes in the bank's asset mix, therefore, will change the overall market risk of the bank's stock returns. I test for these indirect effects by allowing the estimated coefficient β_j to depend (at least partially) on the proportion of the bank's assets allocated to different asset categories.[3] This dependence changes somewhat the interpretation of the direct effects: The estimated λ coefficients from equation (4) reflect the influence of portfolio composition on the nonmarket component of systematic risk.

I assume that the relationship between asset allocations and estimated beta values is additive. Thus, the hypothesis that market risk is variable and depends on portfolio composition can be expressed as

$$(5) \qquad \beta_{jt} = \gamma_{j0} + \textstyle\sum_i \gamma_{ji} P_{jit} + \eta_{jt},$$

where each coefficient γ_{ji} represents the impact of asset share i on the stock market sensitivity of bank j's equity, and γ_{j0} is the portion of market risk that is unrelated to the bank's asset allocations. If portfolio composition affects the market risk of bank stocks, then the estimated values of γ_{ji} should differ significantly from zero. The sign of these coefficients will determine whether the specific asset categories increase or decrease the sensitivity of the bank's stock return to the overall stock market.

These relationships can be expressed in a single equation by substituting equation (5) into equation (4):

[3]This dependence also means that the estimated coefficient varies over time and thus requires a time subscript in the subsequent equation.

$$R_{jt} = \alpha_j + \gamma_{j0} R_{Mt} + \textstyle\sum_i (\gamma_{ji} P_{jit}) \bullet R_{Mt} + \sum_i (\lambda_{ji} P_{jit}) + v_{jt}, \quad (6)$$

where v_{jt} is a combination of the error terms from equations (4) and (5). The dependence of the stock market beta on the composition of the bank's balance sheet adds several "interacted" variables to the empirical model. The interactions are between the return on the market portfolio of stocks and the asset share variables from the bank's portfolio. The coefficients on these interaction terms measure the indirect effects of portfolio composition on the estimated market risk of bank stocks.

An additional bank characteristic that may influence bank stock returns is the financial leverage of the bank. Since banks are subject to capital regulation, there are regulatory limits on the extent to which banking firms can leverage their operations. Nevertheless, many banks choose to hold more (sometimes significantly more) than the required minimum level of capital. Option-based models of bank risk take explicit account of leverage. In the market model approach, leverage effects are implicitly assumed to affect the market beta. In order to isolate these leverage-related differences in risk, I interact bank leverage with the return on the market portfolio. The empirical model becomes

$$R_{jt} = \alpha_j + \gamma_{j0} R_{Mt} + \delta_j LEV_{jt} \bullet R_{Mt} + \textstyle\sum_i (\gamma_{ji} P_{jit}) \bullet R_{Mt} + \sum_i (\lambda_{ji} P_{jit}) + v_{jt}, \quad (7)$$

where LEV_{jt} is the book value of assets divided by the market value of bank equity, and δ_j is an estimated coefficient that reflects the influence of bank leverage on the market risk of bank stock returns.

I make one final adjustment to the model based on econometric considerations. Equation (7) estimated on a time series, cross-section of banking firms constrains the estimated constant term (α in the equation) to be identical across all banks in the sample and over the estimation interval. This constraint may not be appropriate and may bias the estimation results. To account for time-specific effects that may affect all banks in the same way, I add time dummy variables (omitting the first period) to all of the regressions.[4] I do not account for differences in the constant term across banks because I expect that most of the cross-sectional variation in the sample will be captured by the balance sheet variables. Since there is no economic significance to the coefficients on these time period dummy variables, I do not report them in the next section.

In evaluating the results presented below, it is important to recognize that bank stock returns may not be the ideal vehicle for identifying the determinants of risk that may be of interest to bank depositors or regulators. Ideally, it would be preferable to obtain a direct measure of bank asset or portfolio risk, and then search for the determinants of that measure of risk. Unfortunately, such direct measures typically are not available. One way around this problem is to use an option pricing framework to evaluate bank risk. This modeling approach provides an indirect measure of bank asset risk based on the behavior of bank stock and option prices. Examples of option-based models of bank risk include studies by Levonian (1991), and Cordell and King (1992).

In contrast to either direct or indirect measures of bank asset risk, the risk of bank holding company stock returns reflects the market's perception of an amalgam of risks associated with operating a bank. These include asset risk, default risk, deposit insurance risk, charter value risk, etc. Focusing on the risks of holding bank stocks does not provide specific evidence regarding bank asset risk. For example, an increase in bank asset risk will have a positive effect on bank stock risk, but the risk of holding bank stocks could rise for reasons other than an increase in asset risk. Nevertheless, the work presented here does provide important insights into how bank portfolio allocation decisions influence the market's perception of the combination of risks incorporated in bank stocks.

II. Empirical Results on Bank Portfolio Composition and Bank Stock Risk

In this section, I present the results from estimating equation (7) on a sample of 119 bank holding company stock returns over the quarterly interval from 1988 to 1990. The data for (monthly) bank stock returns are drawn from the Compustat bank tapes, are adjusted for dividends and splits, and then are summed to a quarterly frequency. The balance sheet data are taken from quarterly Reports of Condition (Call Reports).

Having two different sources of data for stock returns and balance sheets poses an interesting problem for the empirical work. The stock return data are for bank holding companies. The balance sheet data are for individual banks. The problem is that many of the larger bank holding companies from the Compustat database own or control multiple banks. In combining balance sheet data with the holding company stock returns, it is desirable to have

[4] An alternative method for incorporating the influence of time-specific factors on stock returns is to include a time trend variable in the regressions. This procedure, however, imposes a particular structure on the impact of time on the banks in the sample, namely, it requires this effect to be linear. The procedure used here avoids that restriction while still capturing the impact of time-specific events that influence all banks in a similar way.

accounting data that accurately represent the balance sheet of the holding company. One solution used in previous work (e.g., Flannery and James 1984a and Kwan 1991) is to use accounting data from the largest bank subsidiary of the holding company and to limit the sample to those lead banks that hold at least, say, 75 percent of total holding company assets. For the current project, I summed individual bank data from the Call Reports, thereby building up more complete balance sheets for holding companies with multiple bank subsidiaries. The combined balance sheet data used in this study average well over 90 percent of holding company assets during the four-year estimation interval, considerably higher than in previous studies. The database also includes significant changes in bank structure during this period, as it was necessary to keep track of subsidiary sales and purchases, bank mergers and acquisitions, as well as failures and other resolution procedures. The result of this extensive data project is a consistent sample of 119 of the largest bank holding companies in the U.S. over the 12-quarter interval from 1988.Q1 to 1990.Q4.[5]

All of the reported results are from pooled regressions; no individual bank estimates are reported. Thus, the coefficients represent average estimated coefficients for the banks in the sample. The asterisks in the table reflect the degree of statistical significance of the estimated coefficients. The coefficient for R_M is tested against a null hypothesis that the group of stocks exhibits average market risk, that is, that the value of beta is one. All other tests are performed against a null hypothesis that the estimated coefficient is equal to zero.

Finally, in pooled cross-section regressions of the type presented here, heteroskedasticity is a common problem that can bias estimated standard errors and thus measures of statistical significance. A frequently used procedure to obtain consistent estimates of the covariance matrix and coefficient standard errors is that proposed by White (1980). In all of the regressions reported in this paper, I have employed White's technique to obtain consistent estimates of standard errors.[6]

In Table 1, I present the regression results from the model of bank holding company stock returns using several non-overlapping categories of securities and loans. These asset groups comprise on average about 60 percent of the assets of the banks in the sample. In addition to the on-balance sheet assets, I also include in column (8) of the table the sum of two of the largest categories of off-balance sheet activities: foreign currency and interest rate swaps, options, and other contracts.

In each succeeding column of Table 1, I include in the regression one more asset share variable. In this way, I can determine if an additional asset alters the previous estimates, thereby indicating the presence of multicollinearity among the different asset categories. As the results in the table indicate, the estimated coefficients are fairly stable across the different regressions. Most of the coefficients that are significant in one regression remain so in succeeding columns. Some point estimates do vary across the regressions, and there is a tendency for standard errors to rise somewhat, reducing the significance levels for some coefficients as more balance sheet variables are added.

The estimated value of the market beta ranges between 2.7 and 3.4, suggesting that the banks in the sample exhibited significantly higher than average market risk during this period.[7] Clearly this was an extremely volatile period for bank stock returns relative to the market portfolio of stocks. The leverage variable interacted with the return on the market portfolio is not statistically significant in any of the regressions. This means that differences in bank leverage appear to have no identifiable impact on the market risk of bank holding company stock returns, at least during the period of analysis used in this study.

Among the different categories of assets, the interacted term for the sum of Treasury and government agency securities has a negative coefficient that is statistically significant in all of the regressions. This category encompasses assets with the most favorable risk weights under the risk-based capital guidelines. This includes Treasury securities that require no capital support and mortgage-backed securities issued by FNMA and FHLMC that receive a risk weight of 20 percent. These results provide evidence that holdings of government securities exert a negative impact on the market risk of bank stocks. Banks with a greater proportion of Treasury and agency securities in their portfolios exhibit less stock return volatility with respect to overall movements in the stock market than banks holding a smaller proportion of these assets. This

[5]Although I originally collected data for the four quarters of 1987, preliminary regressions indicated that the 1987 data contained a number of anomalies. I therefore restrict the estimation interval to the 1988 to 1990 period.

[6]White's methodology may not be necessary if there is no evidence of heteroskedasticity in the sample. Tests for the existence of heteroskedasticity showed that it did exist in the current data set and that White's procedure was therefore appropriate.

[7]As in most empirical estimates of market-based models, the value of the market beta depends crucially on the selected time period. Estimated beta values have shown considerable volatility in previous studies (for example, Neuberger 1991). Estimates of the current model that included 1987 showed significantly lower estimated betas. Notably, the other estimated coefficients were relatively stable and quite close to those reported here.

Table 1

Regression Results: Bank Holding Company Stock Returns as a Function of Portfolio Composition, 1988-1990.

Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
R_M	2.730***	2.758***	2.974***	3.101***	3.126***	3.400***	3.455***	3.445***
R_M • Leverage	−0.001	−0.003	−0.003	−0.003	−0.003	−0.003	−0.003	−0.003
(Treasury + Govt. Agency Securities)/Assets	0.081*	0.085*	0.081*	0.084*	0.087*	0.049	0.049	0.014
R_M • (Treas. + Govt. Agency Secs./Assets)	−3.656***	−3.045***	−3.037***	−3.172***	−3.273***	−3.006***	−3.022***	−2.431***
Private Mortgage Securities/Assets		−2.660**	−2.749**	−2.983**	−3.005**	−2.957**	−2.960**	−2.870**
R_M • (Private Mortgage Securities/Assets)		13.511	13.619	19.459	20.442	19.977	20.236	18.703
Commercial Real Estate Loans/Assets			−0.264***	−0.268***	−0.261***	−0.266***	−0.264***	−0.301***
R_M • (Coml. Real Estate Loans/Assets)			1.281	2.221*	2.827**	2.798**	2.742**	3.377**
1-4 Family Residential Loans/Assets				0.009	0.009	−0.006	−0.006	−0.028
R_M • (1-4 Family Residential Loans/Assets)				−1.920**	−1.938**	−1.822**	−1.779**	−1.424
Multifamily Residential Loans/Assets					−0.048	−0.169	−0.159	−0.201
R_M • (Multifamily Res. Loans/Assets)					−9.771	−8.810	−9.035	−8.269
Commercial & Industrial Loans/Assets						−0.098	−0.091	−0.102
R_M • (C & I Loans/Assets)						0.604	0.408	0.594
Loans to Individuals/Assets							0.014	−0.006
R_M • (Loans to Individuals/Assets)							−0.526	−0.202
Currency & Interest Rate Contracts/Assets								−0.004
R_M • (Curr. & Int. Rate Contracts/Assets)								0.070*
$\bar{R}^2$	0.460	0.470	0.472	0.473	0.473	0.473	0.472	0.472
Number of Observations	1428	1428	1428	1428	1428	1428	1428	1428

Note: Sample includes 119 banks. Test for R_M is against null hypothesis that coefficient is equal to 1.0; all other tests are against null hypothesis that coefficients equal zero.

Regressions also include dummy variables for each time period (except 1988.Q1); coefficients on these variables are not reported.

Significance: * = 10 percent level
** = 5 percent level
*** = 1 percent level

result is sensible in light of the relative safety of government securities with respect to default risk. Of course, such securities may expose banks to interest rate risk. The regressions provide some modest support for the existence of significant nonmarket risk associated with these securities. The first five columns show a positive coefficient on the noninteracted government securities variable that is significant at the 10 percent level. The significance of this coefficient disappears in the subsequent regressions, suggesting that the stock market may not price the extramarket risk of these securities in bank portfolios.

For the other category of securities, privately issued mortgage-backed securities, the interacted coefficient is not statistically different from zero in any regression. These securities do not exert any statistically significant impact on the market risk of bank stock returns. However, this asset category does have a stable and significant negative noninteracted coefficient. Larger portfolio shares of private mortgage securities are associated with lower bank stock returns. The stock market in effect imposes a "negative risk premium" on banks with proportionately higher exposure to the nonmarket systematic risks of holding these securities. Apparently, the market considers this exposure to be relatively "safe" for banks, and thus they receive a lower stock return for assuming it.

Among the different loan categories in Table 1, commercial real estate loans exhibit the strongest effect on bank stock returns. The estimated coefficient on this interacted variable is significantly positive in all but the first regression, indicating that these loans increase bank market-related risk. Stock returns of banks with a greater proportion of their assets in commercial real estate loans exhibit greater sensitivity to changes in the overall stock market. At the same time, the noninteracted variable for these loans has a significant and negative coefficient. This suggests that the nonmarket risk of these loans may actually be negative.

The only other loan category to exhibit any significant effect on bank stock returns is the interacted term for one-to-four family residential loans. The estimated coefficient on this variable is negative in all of the regressions and is significant in all but the last column. These results provide support for the notion that home mortgages may reduce the market risk of bank stock returns.

Finally, I consider in column (8) the influence of off-balance sheet activities on bank stock risk and return. These activities have grown rapidly in recent years, especially at larger banks. Some critics suggest that the explosive growth of these activities has increased bank risk in significant, though difficult to measure, ways. Banks defend the use of these instruments by claiming that they provide a hedge against currency and interest rate risk. The risk-based capital standards require some capital support for off-balance sheet activities, recognizing that they entail some credit risk. However, the capital guidelines ignore any risk-reducing effects that such activities may have on currency or interest rate risk.

As the results in column (8) indicate, the off-balance sheet category has a positive and marginally significant estimated coefficient on the interacted variable, suggesting that these activities are associated with greater market risk for bank stock returns.[8] This finding provides some support for including off-balance sheet activities in the risk-based capital regulations and suggests that more work is needed to understand this rapidly growing market. Perhaps more important, the off-balance sheet activities do not show any statistically significant nonmarket risk effects. At least for the banks in the sample, it does not appear that off-balance sheet activities have reduced the extra-market risk of bank stock returns.

Interpretation of Results

The findings presented here highlight a number of interesting aspects regarding the risk of bank stock returns. First, portfolio composition appears to affect both the market and nonmarket systematic risks of bank stock returns.[9] Several categories of assets exert a statistically significant effect on bank market risk through the balance sheet variables interacted with the market return. In addition, several asset categories exert an impact on bank stock returns independent of market risk. In terms of the APT model, this latter finding suggests that the composition of a bank's asset portfolio may represent a set of characteristics that are significant determinants of its (nonmarket) systematic risk profile.

Second, the significant results among the interacted variables provide some interesting empirical evidence regarding the risk hierarchy of the risk-based capital guidelines. Holdings of government securities, for example, appear to

[8]When the two types of off-balance sheet activities were included separately in the regressions, each showed the same statistically significant positive interacted coefficient and no significance for the noninteracted coefficient. However, putting both types of off-balance sheet activities in the same regression produced evidence of multicollinearity. Apparently, the same banks that use interest rate contracts are also those most heavily involved in foreign currency contracts. By combining the two categories into one, their combined effect can be estimated without any statistical problems arising from multicollinearity.

[9]As in all studies of this type, any hypothesis tests are tests of the joint hypothesis that (a) the modified APT model is correct, and (b) portfolio composition is an appropriate set of bank characteristics affecting bank stock returns.

reduce the market risk of bank stocks. This finding provides support for the preferential treatment given to Treasury and other government agency securities in the risk-based capital standards. The absence of credit risk inherent in these securities provides banks with a "safe haven" that is reflected in the reduced market risk of bank stock returns. The weak evidence on the nonmarket risks of government securities also may raise questions regarding the empirical importance of any interest rate risk associated with holding them.

Among several broad categories of bank loans, neither commercial and industrial loans nor loans to individuals have any significant effect on the market risk of bank stock returns. This finding is notable because these two categories of loans receive the highest risk weight under the risk-based capital standards and yet they do not appear to increase the market risk of bank stock returns. This result may raise some doubts as to whether the highest risk weight is appropriate for these categories of loans. In contrast, the results presented here support the preferential treatment given to residential mortgages under the risk-based capital rules. The regressions confirm that residential real estate loans exhibit a significant risk-reducing influence on the market risk of bank stock returns.

An additional interesting finding among the loan categories is the result for commercial real estate loans. These loans exert a strong positive effect on the market risk of bank stock returns. This finding highlights the real source of risk for banks making real estate loans. Even prior to the recent "real estate recession," the risky area of real estate lending for banks has been for commercial projects.

Turning to the noninteracted balance sheet variables, several significant direct coefficients suggest that the corresponding assets are important in explaining nonmarket systematic bank stock risk. Among these assets, government securities have a marginally significant positive risk premium associated with them, while private mortgage securities and commercial real estate loans are associated in the sample with significant negative risk premia.

However, the interpretation of these direct coefficients is somewhat uncertain. The regression model relates portfolio allocations to *realized* returns rather than expected returns as the theory suggests. A significant estimated noninteracted coefficient, therefore, could represent a fundamental relationship between bank stock returns and portfolio composition or it could be indicative of (good or bad) luck on the part of the bank in holding the particular asset during the estimation interval. This is particularly true given the relatively short time period over which the model is estimated. It is thus unclear, for example, whether commercial real estate loans systematically affect the nonmarket risk profile of bank stock returns or whether banks that made these loans in the 1988 to 1990 period were the victims of poor performance by these assets.

This same uncertainty should not affect the interacted coefficients in the regressions. These coefficients represent the influence on market risk of the particular asset category relative to the average market beta of the banks in the sample. Each asset in banks' portfolios may be considered to have its own associated market beta value. Thus, there may exist a "beta" for making residential mortgage loans or a similar measure for holding government securities. The aggregate beta that a bank exhibits thus will be a weighted average of the individual betas associated with the different assets in its portfolio. As the asset mix changes, so will the bank's market risk. If the market model is an appropriate representation of asset returns, then these interacted effects may be stable over time.

III. Conclusion

In the current paper, I conduct an empirical analysis of the behavior of bank holding company stock returns with the goal of identifying the effect of portfolio composition on the risks embodied in those returns. I find that several categories of assets in bank securities and loan portfolios do alter the risk profile of bank stock returns. Among other things, I discuss the importance of these findings in light of the risk-based capital standards and the different risk weight categories that those standards use. The risk-based capital guidelines are an important step in establishing regulations that measure bank risk more accurately. However, these standards may need to be modified as new evidence is uncovered about the risk effects of different bank activities. Moreover, as banks respond to a changing economic and regulatory environment, their asset mix may change and alter the risk profile of their portfolios. This undoubtedly has happened, for example, with respect to off-balance sheet activities. Capital regulation may need to respond as well to these changing realities if required capital levels are to reflect bank risk accurately.

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